

**The Flavor and Fragrance High Production Volume
Consortia**

201-16471C

The Cyclohexyl Derivatives Consortium

RECEIVED
OPPT CBIC
2006 DEC 28 AM 9:49

**Revised Robust Summaries for
Alkyl-substituted Cyclohexanol Derivatives**

4-*tert*-butylcyclohexanol CAS No. 98-52-2

4-*tert*-butylcyclohexyl acetate CAS No. 32210-23-4

**FFHPVC Cyclohexyl Derivatives Consortium
Registration Number**

**Submitted to the EPA under the HPV Challenge Program by:
The Flavor and Fragrance High Production Volume Chemical Consortia**

1620 I Street, NW, Suite 925

Washington, DC 20006

Phone: 202-331-2325

Fax: 202-463-8998

List of Member Companies

FIRMENICH, INC.

INTERNATIONAL FLAVORS & FRAGRANCES INC.

J. MANHEIMER, INC.

QUEST INTERNATIONAL

DEGUSSA AG/DEGUSSA CORPORATION

Table of Contents

1	CHEMICAL AND PHYSICAL PROPERTIES	3
1.1	MELTING POINT	3
1.2	BOILING POINT	6
1.3	VAPOR PRESSURE	8
1.4	N-OCTANOL/WATER PARTITION COEFFICIENTS.....	11
1.5	WATER SOLUBILITY.....	13
2	ENVIRONMENTAL FATE AND PATHWAYS.....	15
2.1	PHOTODEGRADATION	15
2.2	STABILITY IN WATER.....	16
2.3	BIODEGRADATION	16
2.4	FUGACITY	20
3	ECOTOXICITY.....	24
3.1	ACUTE TOXICITY TO FISH.....	24
3.2	ACUTE TOXICITY TO AQUATIC INVERTEBRATES.....	29
3.3	ACUTE TOXICITY TO AQUATIC PLANTS	35
4	HUMAN HEALTH TOXICITY.....	39
4.1	ACUTE TOXICITY	39
4.2	GENETIC TOXICITY	46
4.2.1	<i>In vitro Genotoxicity</i>	46
4.2.2	<i>In vivo Genotoxicity</i>	49
4.3	REPEATED DOSE TOXICITY	55
4.4	REPRODUCTIVE TOXICITY.....	58
4.5	DEVELOPMENTAL/TERATOGENICITY TOXICITY ERROR! BOOKMARK NOT	
	DEFINED.	

The Flavor and Fragrance High Production Volume Consortia

Revised Robust Summaries for Alkyl-substituted Cyclohexanol Derivatives

The evaluation of the quality of the following data uses a systematic approach described by Klimisch [Klimisch *et al.*, 1996]. Based on criteria relating to international testing standards for categorizing data reliability, four reliability categories have been established. The following categories are:

- Reliability code 1. Reliable without restrictions
- Reliability code 2. Reliable with restrictions
- Reliability code 3. Not reliable
- Reliability code 4. Not assignable

Summary of Key Hazard Data for Alkyl-substituted Cyclohexyl Derivatives

Endpoint	Substance/Surrogate ¹	Value/Range ²	Reference
Physical Properties			
Vapor Pressure	4- <i>t</i> -Butylcyclohexanol 4- <i>t</i> -Butylcyclohexyl acetate	<0.01 kPa (25 °C) 0.0067 kPa (20 °C)	Degussa AG, 2003a Huels AG, 1985
Partition Coefficient	4- <i>t</i> -Butylcyclohexanol 4- <i>t</i> -Butylcyclohexyl acetate	3.23 (OECD 117) 4.8 (OECD 117)	Degussa AG, 1981 Givaudan-Roure, 1996
Water Solubility	4- <i>t</i> -Butylcyclohexanol 4- <i>t</i> -Butylcyclohexyl acetate	<100 mg/l at 20 °C ca. 90 mg/l at 20 °C	Degussa AG, 2003a Degussa AG, 2003b

¹ Surrogate is a structurally related substance include a metabolic product or precursor of the named substance

² Experimental value or values for a substance or group of substances in the chemical category

Environmental Fate			
Biodegradation	4- <i>t</i> -Butylcyclohexanol	19d/90%/(EG-Guideline 84/449/EWG C.3)	Degussa AG, 1983
	4- <i>t</i> -Butylcyclohexyl acetate	28d/75%/(EC-Guideline 92/69/E, CO2 Evolution test)	Degussa AG, 1997b
		28d/54% (OECD 301F)	Rudio, 1996a
Ecotoxicity			
Fish	4- <i>t</i> -Butylcyclohexanol	48-hr/LC50=17 mg/L	Degussa AG, 1987
	4- <i>t</i> -Butylcyclohexyl acetate	48-hr/LC50=14 mg/L 96-hr/LC50=8.6	Degussa AG, 1985a Degussa AG, 1997c
Aquatic Invertebrates	4- <i>t</i> -Butylcyclohexanol	48-hr LC50 = 46 mg/L	Degussa AG, 1994b
	4- <i>t</i> -Butylcyclohexyl acetate	48-hr LC50 = 23.4 mg/L	Degussa AG, 1997a
Aquatic Plants	4- <i>t</i> -Butylcyclohexanol	72-hr EC50 = 29mg/L	Degussa AG, 1994a
	4- <i>t</i> -Butylcyclohexyl acetate	72-hr EC50 = 19 mg/L	Degussa AG, 1992
Human Health			
Repeat Dose (route)	4- <i>t</i> -Butylcyclohexanol	28-d LOAEL: 150 mg/kg bw/d and NOAEL=50 mg/kg bw/d (OECD No. 407 Guideline Study)	Degussa AG, 1999
Reproductive	4- <i>t</i> -Butylcyclohexanol	NOAEL =50 mg/kg bw/d (no effects to reproductive organs and tissues)	Degussa AG, 1999
	4- <i>t</i> -Butylcyclohexyl acetate	Maternal NOAEL=460 mg/kg bw/d	Lewis, 2006
Developmental(route)	4- <i>t</i> -Butylcyclohexyl acetate	Maternal NOAEL=460 mg/kg bw/d Developmental NOAEL=460 mg/kg bw/d (preliminary data)	Lewis, 2006
in vitro Genotoxicity³	4- <i>t</i> -Butylcyclohexanol	-(AMS)	Degussa AG, 1988a
		- (ABS)	Degussa AG, 1997
	4- <i>t</i> -Butylcyclohexyl acetate	- (AMS)	Degussa AG, 1989

³ (-), no significant evidence; (+/-), equivocal evidence; (+), positive evidence of genotoxicity

1 CHEMICAL AND PHYSICAL PROPERTIES

1.1 Melting Point

Substance Name	4-tert-Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Assay: >99% trans isomer
GLP	No
Year	1960
Melting Point	82.5-83 °C
Remarks for General Remarks	Data from stereoselective synthesis of cis and trans isomers
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	E. L. Eliel and M. N. Rerick, <i>J. Am. Chem. Soc.</i> , 82 , 1367 (1960).

Substance Name	4-tert-Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Assay: >94% of cis isomer
Melting Point	56.6-58.6 °C
Remarks for General Remarks	Handbook data (Beilstein).
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Krestinina, T. B.; Koshe'el', G. N.; Chabutkina, E. M.; Antonova, T. N.; Migachev, G. I.; JAPUAW; J.Appl.Chem.USSR (Engl.Transl.); EN; 57; 9; 1984; 2138-2142; ZPKHAB; Zh.Prikl.Khim. (Leningrad); RU; 57; 9; 1984; 2318-2324;

Substance Name	4-tert-Butylcyclohexanol
-----------------------	--------------------------

CAS No.	98-52-2
GLP	No
Year	1965
Melting Point	56-58 °C
Remarks for General Remarks	Handbook data, Beilstein data base. Mixture of cis and trans isomers
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	General Aniline + Film Corp.; Patent; FR 1411988; 1965; Chem.Abstr.; EN; 64;1983c; 1966;

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	55-70 °C
Remarks for Results	Mixture of cis and trans isomers.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Fragrance Materials Association (FMA) Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Calculated. Mean or weighted MP.
Melting Point	4.34 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	MPBPVPWIN EPI Suite (2000) US Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	ASTM-D-1015

GLP	No
Melting Point	Less than -50 °C
Decomposition	No
Sublimation	No
Remarks for Results	Data are for mixture of cis and trans isomers
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (2003b) Safety Data Sheet for 4- <i>tert</i> -Butylcyclohexyl acetate. Degussa AG (1998) Product information, Data Sheet 1401, 1.12.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Calculated Mean or weighted MP
Melting Point	10.93 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	MPBPVPWIN EPI Suite (2000) US. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Mixture of cis and trans isomers
Method/guideline	ASTM-D-1015
GLP	No
Melting Point	-50 °C
Decomposition	No
Sublimation	No
Remarks for Results	Data are for mixture of cis and trans isomers
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.

References

Merck KGaA Data information sheet
www.kimyaevi.org/d01/814083

1.2 Boiling Point

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Experimental
Boiling Point	110 °C
Pressure	15 mm Hg
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Fragrance Materials Association (FMA) Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Experimental
GLP	No
Boiling Point	224-228 °C
Pressure	1013 hPa (759.5 mm Hg)
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (2003a) Safety Data Sheet for 4- <i>tert</i> -butylcyclohexanol. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	ASTM-D-1078 (Experimental)

GLP	No
Boiling Point	223 °C
Pressure	1013 hPa (759.5 mm Hg)
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (1998a) Product information for 4- <i>tert</i> -butylcyclohexanol, Data Sheet 1391, 1.12. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Calculated. Adapted Stein & Brown method.
Boiling Point	216.91 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	MPBPVPWIN EPI Suite (2000) U.S. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Mixture of cis and trans isomers
Method/guideline	Experimental
Boiling Point	260 °C
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Fragrance Materials Association (FMA) Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	ATSDM-D-1078 (Experimental)
GLP	No
Boiling Point	241 °C

Pressure	1013 hPa
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (1998b) Product information for 4- <i>tert</i> -butylcyclohexyl acetate, Data Sheet 1401, 1.12. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Calculated/Adapted Stein & Brown method
Boiling Point	232.55 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	MPBPVPWIN EPI Suite (2000) U.S. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Results	99% mixture of cis and trans isomers
Method/guideline	Experimental
GLP	No
Boiling Point	228-230°C
Pressure	25 mm Hg
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Aldrich Handbook of Chemicals (2006) p. 526

1.3 Vapor Pressure

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Experimental
GLP	No
Remarks for Substance	The value at 20 °C is obtained by extrapolation of the data given: 104.3°C, 13.3 hPa; 150 °C: 119 hPa (1.0 hPa=0.1kPa)_
Vapor Pressure	Less than 0.1 hPa (<0.01 kPa) <0.075 mm Hg
Temperature	20 °C
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (2003a) Safety Data Sheet for 4- <i>tert</i> -butylcyclohexanol. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Calculated (estimated from boiling point data)
Vapor Pressure	0.005 mm Hg
Temperature	20 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	Fragrance Materials Association (FMA) Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Calculated/Mean VP of Antoine & Grain methods
Vapor Pressure	0.0263 mm Hg
Temperature	25 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.

References MPBPVPWIN EPI Suite (2000) U.S. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
GLP	No
Vapor Pressure	0.01 hPa (0.0075 mm Hg)
Temperature	20 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Only short abstract available.
References	Degussa AG (2003b) Safety Data Sheet for 4- <i>tert</i> -butylcyclohexyl acetate. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Experimental
GLP	No
Remarks for Substance	The value at 20 °C is obtained by extrapolation of the data given: 241 °C: 1013 hPa, 200 °C: 366 hPa, 150 °C: 73 hPa, 100 °C: 8 hPa, Experimentally derived relationship: $\log(VP) = -2866 * (1/T) + 8.6061$ (T in K, VP in hPa) (1.0 hPa=0.1kPa)_
Vapor Pressure	Approximately 0.067 hPa (0.0067kPa=0.0502 mm Hg)
Temperature	20 °C
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Huels AG (1985) Produktdatenblatt "p- <i>tert</i> -Butylcyclohexylacetat", Artikel-Nr. 002304, 01-MAR-85. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Calculated (Estimated from boiling point data)
Vapor Pressure	0.03 mm Hg

Temperature	20 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	Fragrance Materials Association (FMA) Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Calculated/Mean VP of Antoine & Grain methods
Vapor Pressure	0.0159 mm Hg
Temperature	25 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	MPBPVPWIN EPI Suite (2000) U.S. Environmental Protection Agency.

1.4 n-Octanol/Water Partition Coefficients

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	OECD Guideline 107
GLP	No
Year	1981
Remarks for Test Conditions	Flask shaking method GC analysis of the test substance No further data
Log Pow	3.23
Remarks for Results	Summary report of results.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.

Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (1981) Unpublished Report No. 89-0514-DKP.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Calculated
Log Pow	3.42
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	KOWWIN EPI Suite (2000) U.S. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Purity: 70.7% trans, 28.3 cis by GC
Method/guideline	Reverse phase HPLC method (OECD 117)
Year	1996
Log Pow	4.8 at 25 °C
Remarks for Results	For both isomers
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Givaudan-Roure (1996) Partition coefficient n-octanol/water of 4- <i>tert</i> -butylcyclohexyl acetate. Unpublished.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Calculated
Log Pow	4.42
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	KOWWIN EPI Suite (2000) U.S. Environmental Protection Agency.

1.5 Water Solubility

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Experimental
GLP	No
Value (mg/L) at Temperature	Less than 100 mg/L at 20 °C
Description of Solubility	Of very low solubility
Remarks for Results	Following 24-hrs agitation and 24 hours undisturbed, aqueous layer extracted and the extract analyzed by glc
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (2003a) Safety Data Sheet for 4- <i>tert</i> -butylcyclohexanol. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/Guideline	Calculated
Value (mg/L) at Temperature	528.9 at 25 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	WSKOWIN EPI Suite (2000) US Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Experimental
GLP	No

Value (mg/L) at Temperature	ca. 90 mg/L at 20 °C
pH	7
Remarks for Results	Following 24-hrs agitation and 24 hours undisturbed, aqueous layer extracted and the extract analyzed by glc
Data Qualities Reliabilities	Reliability code 2. Reliable with restrictions.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (2003b) Safety Data Sheet for 4- <i>tert</i> -butylcyclohexyl acetate. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/Guideline	Calculated
Value (mg/L) at Temperature	2.552 at 25 °C
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	WSKOWIN EPI Suite (2000) U.S. Environmental Protection Agency.

2 ENVIRONMENTAL FATE AND PATHWAYS

2.1 Photodegradation

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Calculation
Test Type	AOPWIN
Half-life t_{1/2}	6.361 hours
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	AOPWIN EPI Suite (2000) U S Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Calculation
Test Type	AOPWIN
Half-life t_{1/2}	8.850 hours
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	AOPWIN EPI Suite (2000) U S Environmental Protection Agency.

2.2 Stability in Water

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method	Calculated
Half-life t_{1/2}	266 days at pH 8
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	HYDROWIN EPI Suite (2000) US Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method	Calculated
Half-life t_{1/2}	7.2 years at pH 7
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	HYDROWIN EPI Suite (2000) US Environmental Protection Agency.

2.3 Biodegradation

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method	EG-Guideline 84/449/EWG C.3
Test Type	Aerobic
GLP	No

Year	1983
Contact time (units)	19 days
Innoculum	Predominantly domestic sewage
Remarks for Test Conditions	Concentration: 20 mg/L related to DOC (dissolved organic carbon). TEST CONDITION - Additional substrate: No - Test temperature: 20 +- 2°C Kinetics: 5 d: 6% 14 d: 17% 19 d: 89 %
Degradation % After Time	90% after 19 days
Results	Readily biodegradable
Time required for 10% degradation	Approximately 9 days
10 day window criteria	Fulfilled
Total degradation	90 %
Classification	Readily biodegradable
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Acceptable, well-documented publication/study report, which meets basic scientific principles.
Reference	Degussa AG (1983) Unpublished report. Report No. 96-0464-DKO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method	EC-Guideline 92/69/E, CO2 Evolution test
Test Type	Aerobic
GLP	Yes
Year	1992
Innoculum	Activated sludge, domestic
Remarks for Test Conditions	INOCULUM - Source: Kläranalge Marl Ost Initial cell concentration: 122 x 10exp4 colony building units/L INITIAL TEST SUBSTANCE CONCENTRATION: 20,6 to 20,8

	mg/l
	Test temperature: 20.4-23.6 °C
	- pH value: 7.5-7.6
	- suspended solids: 29.7 mg/l
Degradation % After Time	75% after 28 days
Results	Readily biodegradable
Time required for 10% degradation	Approximately 5 days
10 day window criteria	Yes
Total degradation	75%
Classification	Readily biodegradable
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Remarks for Data Reliability	Code 1. Comparable to guideline study.
Reference	Degussa AG (1997b) Unpublished report. Report No, 97-0300-DGO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method	ISO Draft "BOD Test for insoluble substance"
Test Type	Aerobic
GLP	No
Year	1995
Contact time (units)	28 days
Innoculum	Activated sludge, domestic
Remarks for Test Conditions	INNOCULUM - Source: Lippeverband-Kläranlage Marl INITIAL TEST SUBSTANCE CONCENTRATION: 51.5 mg/l DURATION OF THE TEST: 28 days ANALYTICAL PARAMETER: Oxygen consumption SAMPLING: on days 0, 7, 14, 21, 28 Control: Diethylene glycol
Degradation % After Time	68% after 28 days
Time required for 10% degradation	Approximately 10 days

10 day window criteria	Not met
Total degradation	68 %
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
Reference	Degussa AG (1995) Unpublished report. Report No. 95-0220-DKO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Purity: 70.8% trans, 28.3% cis by GC
Method	Respirometric Method, modified MITI test II (OECD Guideline No. 302 C)
GLP	Yes
Year	1995
Contact time (units)	Up to 28 days
Innoculum	Fresh activated sludge, domestic sewage
Remarks for Test Conditions	Dry weight of suspended solids=3.980 g/L; sludge concentration= 100 mg/L (d.w.); nominal concentration=30 mg/L; temperature=22 deg C; biodegradation began on day 12
Degradation % After Time	24% after 28 days
Results	Not inherently but partially biodegradable
Time required for 10% degradation	12-14 days
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Remarks for Data Reliability	Code 1. Guideline study.
Reference	Rudio J. (1996b) Inherent biodegradability of 4- <i>tert</i> -butylcyclohexyl acetate according to OECD Guideline No. 302 C. Givaudan Roure Test Report No. 96-E51. Unpublished, dated June 24, 1996.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Purity: 70.8% trans, 28.3% cis by GC
Method	Manometric Respirometric Test (OECD Guideline No. 301 F)
Test Type	Yes

GLP	Yes
Year	1996
Contact time (units)	Up to 28 days
Innoculum	Fresh activated sludge, domestic sewage
Remarks for Test Conditions	Dry weight of suspended solids=4.366 g/L; sludge concentration= 30 mg/L (d.w.); nominal concentration=100 mg/L; temperature=22 deg C; biodegradation began on day 15
Degradation % After Time	54% after 28 days
Results	Not readily biodegradable
Time required for 10% degradation	15 days
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Remarks for Data Reliability	Code 1. Guideline study.
Reference	Rudio J. (1996a) Ready biodegradability of butylcyclohexyl acetate according to OECD Guideline No. 301 F. Givaudan Roure. Unpublished, dated January 17, 1996.

2.4 Fugacity

Substance Name	4-tert-Butylcyclohexyl acetate
CAS No.	32210-23-4
Model Conditions	25 C, 1000 lbs.
Test Type	Environmental Equilibrium Partitioning Model
Method	Mackay
Model Used	EQC Fugacity Level III
Input Parameters	MW (198.30g/mole), VP(0.050 mm Hg), log Kow (4.8), water solubility (90 mg/L), BP (241) estimated MP (-50)
Year	2000
Model data and results	Compartment half-lives, hours: Air=17.7; Water=900; Soil=900; Sediment=3600
Estimated Distribution and Media Concentration	Air=1.36% Water=18.1% Soil=66%

Sediment=14.6%

Conclusion remarks	Substance is predicted to persist in the environment for 656hours (27 days). Persistence data consistent with an experimentally measured biodegradation rate.
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	Mackay D. (1991) Multimedia Environmental Models; The Fugacity Approach, Lewis Publishers, CRC Press, pp 67-183. Mackay D., A.DiGuardo, S.Paterson, G.Kicsi and C.E.Cowan (1996a) Assessing the fate of new and existing chemicals: a five-stage process. Environmental Toxicology and Chemistry, 15(9), 1618-1626. Mackay D., A.DiGuardo, S.Paterson and C.E.Cowan (1996b) Evaluating the fate of a variety of types of chemicals using the EQC model. Environmental Toxicology and Chemistry, 15(9), 1627-1637.
Substance	4- <i>tert</i> -Butylcyclohexanol
CAS	98-52-2
Model Conditions	25 C, 1000 lbs.
Test Type	Environmental Equilibrium Partitioning Model
Method	Mackay
Model Used (title, version, date)	EQC Fugacity Level III
Input parameters	MW (156.27g/mole), VP(0.0075 mm Hg), log Kow (3.23), water solubility (100 mg/L), BP (226) estimated MP (55-70)
Year	2000
Media	Air-Water-Soil-Sediment Partition Coefficients
Model data and results	Compartment half-lives, hours: Air=12.7; Water=360; Soil=360; Sediment=1440
Estimated Distribution and Media Concentration	Air=1.87% Water=38.1% Soil=59.5% Sediment=0.588%
Conclusion remarks	Substance is predicted to persist in the environment for 289 hours. Persistence data consistent with an

experimentally measured biodegradation rate.

Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	The data are obtained by a recognized fugacity calculation method. Data are considered reliable with restriction because this method does not allow for biodegradation or metabolism.
References	Mackay D., A.DiGuardo, S.Paterson and C.E.Cowan (1996b) Evaluating the fate of a variety of types of chemicals using the EQC model. Environmental Toxicology and Chemistry, 15(9), 1627-1637.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Test Type	Environmental Equilibrium Partitioning Model
Method	Mackay
Model Used	Level III Fugacity-based Environmental Equilibrium Partitioning Model
Input Parameters	MW, calculated VP, calculated MP, calculated Kow
Year	2000
Model data and results	Air = .92% Water = 37.9% Soil = 59.7% Sediment = 0.468%
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	Mackay D. (1991) Multimedia Environmental Models; The Fugacity Approach, Lewis Publishers, CRC Press, pp 67-183. Mackay D., A.DiGuardo, S.Paterson, G.Kicsi and C.E.Cowan (1996a) Assessing the fate of new and existing chemicals: a five-stage process. Environmental Toxicology and Chemistry, 15(9), 1618-1626. Mackay D., A.DiGuardo, S.Paterson and C.E.Cowan (1996b) Evaluating the fate of a variety of types of chemicals using the EQC model. Environmental Toxicology and Chemistry, 15(9), 1627-1637.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4

Model Conditions	Mackay
Test Type	Environmental Equilibrium Partitioning Model
Model Used	Level III Fugacity-based Environmental Equilibrium Partitioning Model
Input Parameters	MW, calculated VP, calculated MP, calculated Kow
Year	2000
Model data and results	Air = 1.66% Water = 14.9% Soil = 71.3% Sediment = 12.1%
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
References	<p>Mackay D. (1991) Multimedia Environmental Models; The Fugacity Approach, Lewis Publishers, CRC Press, pp 67-183.</p> <p>Mackay D., A.DiGuardo, S.Paterson, G.Kicsi and C.E.Cowan (1996a) Assessing the fate of new and existing chemicals: a five-stage process. Environmental Toxicology and Chemistry, 15(9), 1618-1626.</p> <p>Mackay D., A.DiGuardo, S.Paterson and C.E.Cowan (1996b) Evaluating the fate of a variety of types of chemicals using the EQC model. Environmental Toxicology and Chemistry, 15(9), 1627-1637.</p>

3 ECOTOXICITY

3.1 Acute Toxicity to Fish

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	DIN 38412 part 15
Test Type	Static
GLP	No
Year	1987
Species/Strain/Supplier	Fish/ <i>Leuciscus idus</i> (Fresh water)
Exposure Period	48 hours
Analytical monitoring	No
Remarks for Test Conditions	<p>TEST ORGANISMS</p> <ul style="list-style-type: none"> - Strain: <i>Leuciscus idus melanotus</i> - Supplier: Fischzucht Eggers / Hohenwestedt - Size/weight/loading: 6 cm +- 2 cm / 10 - Feeding: Tetramin before start of test - Pretreatment: 14 d prior to experiment, Zephirol 1: 1000 for 1 hour - Feeding during test: no <p>STOCK AND TEST SOLUTION AND THEIR PREPARATION</p> <ul style="list-style-type: none"> - Vehicle, solvent: no <p>STABILITY OF THE TEST CHEMICAL SOLUTIONS: stable</p> <p>REFERENCE SUBSTANCE: no</p> <p>DILUTION WATER</p> <ul style="list-style-type: none"> - Source: dechlorinated drinking water - Aeration: continuously - Hardness: no data - pH: 7.9 to 8.3 - Oxygen content: 8.3 to 9.5 mg/l
Unit	mg/L
Remarks fields for results	RESULTS:

	- Nominal/measured concentrations: nominal only: 13, 16, 20 mg/l
	- Effect data (Mortality): 13 mg/l: 0% 16 mg/l: 20% 20 mg/l: 100 %
Conclusion Remarks	LC50 = 17 mg/L LC0 = 13 mg/l LC100= 20 mg/l
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
Reference	Degussa AG (1987) Unpublished report. Report No. 96-0394-DKO.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	Fish
Exposure Period	96 hour
Remarks for Test Conditions	Based on: log KOW = 3.23, MP = 67 °C, water solubility = 100 mg/L
Unit	mg/L
Endpoint value	LC50 = 8.085
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) U.S. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	Fish

Exposure Period	14 days
Remarks for Test Conditions	Based on: log KOW = 3.23, MP = 67 °C, water solubility = 100 mg/L
Unit	mg/L
Endpoint value	LC50 = 17.805
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) U.S. Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	DEV DIN 38412 part 15
Test Type	Static
GLP	No
Year	1985
Species/Strain/Supplier	Fish/ <i>Leuciscus idus</i> , fresh water
Exposure Period	48 hours
Analytical monitoring	No
Remarks for Test Conditions	<p>TEST ORGANISMS</p> <ul style="list-style-type: none"> - Strain: <i>Leuciscus idus melanotus</i> - Supplier: Fa. Ekkerts - Loading: 10 per vial - Feeding: Tetramin - Pretreatment: Zephirol 1: 50000 - Feeding during test: no <p>DILUTION WATER</p> <ul style="list-style-type: none"> - Source: Drinking water dechlorinated <p>Temperature: 20+-1°C</p> <p>pH: 7.6-7.8</p> <p>Hardness: 15°dH</p> <p>Dissolved oxygen: 7.3-8.1 mg/l</p> <p>Statistical analysis: Linear regression</p>
Nominal concentrations as mg/L	10 to 20

Unit	mg/L								
Endpoint value	Mortality								
Remarks fields for results	<p>Because of the low solubility of the test substance a solubilizer was used Marlowet EF.</p> <p>RESULTS:</p> <p>- Nominal concentrations (mg/l): Mortality %</p> <table> <tr><td>10</td><td>0</td></tr> <tr><td>13</td><td>10</td></tr> <tr><td>16</td><td>80</td></tr> <tr><td>20</td><td>100</td></tr> </table> <p>- Concentration / response curve: slope: 4.8, correlation coefficient: 0.98</p> <p>LC50: 14 mg/l</p> <p>95 %Confidence limit: 11 - 19 mg/l</p>	10	0	13	10	16	80	20	100
10	0								
13	10								
16	80								
20	100								
Conclusion Remarks	<p>LC0 = 10 mg/L, LC50 = 14 mg/L, LC100 = 20 mg/L</p> <p>Confidence limit: 11-19 mg/L.</p>								
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.								
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.								
Reference	Degussa AG (1985a) Unpublished report. Report. No. 85-0370-DKO.								

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Purity 99.1 %
Method/guideline	CE Guideline 92/69/EEC, part C1
Test Type	Semistatic
GLP	Yes
Year	1992
Species/Strain/Supplier	Fish/ <i>Cyprinus carpio</i> , fresh water
Exposure Period	96 hours
Analytical monitoring	Yes
Remarks for Test Conditions	<p>As the test substance was not readily soluble in water, a suspension of 1 g test substance/L was stirred for 18 hours. After that a filtrate of the suspension was used for the test. Groups of 10 juvenile fish were exposed to one of six nominal concentrations of the test substance in a semi-static test. Solution renewal was made every 24 hours. Solutions were</p>

	maintained at the conditions of pH, hardness, oxygen level, and temperature cited below.
Nominal concentrations as mg/L	4.0 to 34
Measured concentrations as mg/L	4.0 to 34
Unit	mg/L
Endpoint value	Death
Remarks fields for results	Temperature: ca. 20 °C Dissolved oxygen: 85-100% saturation pH: 8.0-8.4 Hardness: 12.5-13 degree dH
Conclusion Remarks	LC0 = 6.7 mg/L, LC50 = 8.6 mg/L, LC100 = 12 mg/L.
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Remarks for Data Reliability	Code 1. Comparable to guideline study.
Reference	Degussa AG (1997c) Unpublished report. Report No. 97-0304-DGO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	Fish
Exposure Period	96 hour
Remarks for Test Conditions	Based on: log KOW = 4.80, water solubility = 90 mg/L
Unit	mg/L
Endpoint value	LC50 = 0.954
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) U.S. Environmental Protection Agency.

3.2 Acute Toxicity to Aquatic Invertebrates

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Purity: 99 %
Method/guideline	EC Guideline 92/69/EEC
Test Type	Experimental
GLP	Yes
Year	1992
Analytical procedures	TOC analysis
Species/Strain/Supplier	<i>Daphnia magna</i>
Test Details	48 hours
Remarks for Test Conditions	<p>TEST ORGANISMS</p> <ul style="list-style-type: none"> - Strain: <i>Daphnia magna</i> - Source/supplier: Hüls AG Prüfinstitut für Biologie, Marl, Germany - Breeding method: in M4 medium (Elendt, 1990), 1 l bakers - Age: < 24 h - Feeding: <i>Scenedesmus subspicatus</i> - Pretreatment: no - Feeding during test: no - Control group: yes <p>STOCK AND TEST SOLUTION AND THEIR PREPARATION</p> <ul style="list-style-type: none"> - Dispersion: 1 g/l in synthetic fresh water, mixing over 18 hours, filtration, DOC determination. <p>Reference substance: potassium dichromate</p> <p>STABILITY OF THE TEST CHEMICAL SOLUTIONS: stable</p> <p>DILUTION WATER</p> <ul style="list-style-type: none"> - Source: synthetic fresh water <p>CaCl₂ x 2 H₂O: 294 mg/l</p> <p>MgSO₄ x 7 H₂O: 123 mg/l</p> <p>NaHCO₃: 63 mg/l</p> <p>KCl: 5.5 mg/l</p> <ul style="list-style-type: none"> - Aeration: no

	- Hardness: Ca ²⁺ and Mg ²⁺ : 2.5 mmol/l
	- TOC: 0
	- Ca/Mg ratio: 4:1
	- Na/K ratio: 10:1
	- pH: 7.7 to 7.8
	- Oxygen content: 7.9 to 8.1 mg/l
Measured concentrations as mg/L	Less than 20 % deviation from nominal conc.
EC50, EL50, LC0, at 24,48 hours	EC0 = 25, EC50 = 46, EC100 = 75 mg/L.
Biological observations	EC50 (24 h): 46 mg/l EC50 (48 h): 46 mg/l
Control response satisfactory?	Yes
Appropriate statistical evaluations?	Yes
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Data Reliability Remarks	Code 1. Comparable to guideline study.
Reference	Degussa AG (1994b) Unpublished report. Report No.: 94-0228-DGO.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	<i>Daphnia Magna</i>
Test Details	48 hours
Remarks for Test Conditions	Based on: log KOW = 3.23, MP = 67 °C, water solubility = 100 mg/L
EC50, EL50, LC0, at 24,48 hours	LC50 = 9.431 at 48 hours
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Data Reliability Remarks	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) US Environmental Protection Agency.
Substance Name	4- <i>tert</i> -Butylcyclohexanol

CAS No.	98-52-2
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	Mysid shrimp
Test Details	96 hours
Remarks for Test Conditions	Based on: log KOW=3.23, MP=67 °C, water solubility=100 mg/L
EC50, EL50, LC0, at 24,48 hours	LC50 = 0.969 at 96 hours
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Data Reliability Remarks	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) US Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Purity 99.1%
Method/guideline	EG EG92/69/EWG
Test Type	Static
GLP	Yes
Year	1997
Analytical procedures	DOC
Species/Strain/Supplier	<i>Daphnia magna</i>
Test Details	48 hours
Remarks for Test Conditions	<p>TEST ORGANISMS</p> <ul style="list-style-type: none"> - Strain: <i>Daphnia magna</i> - Source/supplier: Hüls AG Prüfinstitut für Biologie, Marl, Germany - Breeding method: in M4 medium (Elendt, 1990), 1 l bakers - Age: < 24 h - Feeding: <i>Scenedesmus subspicatus</i> - Pretreatment: no - Feeding during test: no - Control group: yes <p>STOCK AND TEST SOLUTION AND THEIR PREPARATION</p>

- Dispersion: 1 g/l in synthetic fresh water, mixing over 18 hours, filtration, DOC determination.

Reference substance: potassium dichromate

STABILITY OF THE TEST CHEMICAL SOLUTIONS: stable

DILUTION WATER

- Source: synthetic fresh water

CaCl₂ x 2 H₂O: 294 mg/l

MgSO₄ x 7 H₂O: 123 mg/l

NaHCO₃: 65 mg/l

KCl: 6 mg/l

- Aeration: no

- Hardness: Ca²⁺ and Mg²⁺: 2.5 mmol/l

- TOC: 0

- Ca/Mg ratio: 4:1

- Na/K ratio: 10:1

- pH: 7.7 to 7.8

- Oxygen content: 8.9 to 9.1 mg/l

Temperature: 20±1°C

Nominal concentrations as mg/L 2.8-28-4

Measured concentrations as mg/L 2.4-28-4

EC50, EL50, LC0, at 24,48 hours EC50 = 23.4, EC10 = 8.7, EC100 > 28.1

Control response satisfactory? Yes

Appropriate statistical evaluations? Yes

Data Qualities Reliabilities Reliability code 1. Reliable without restriction.

Data Reliability Remarks Code 1. Guideline study.

Reference Degussa AG (1997a) Unpublished report. Report No. 97-0302-DGO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	DIN 38412 part 11
Test Type	Static
GLP	No

Year	1985
Analytical procedures	DOC
Species/Strain/Supplier	<i>Daphnia magna</i>
Test Details	24 hour
Remarks for Test Conditions	<p>TEST ORGANISMS</p> <ul style="list-style-type: none"> - Strain: <i>Daphnia magna</i> - Supplier: Hüls AG - Age/loading: < 1 d, 5 - Feeding: Chlorella Vulgaris - Feeding during test: no <p>STOCK AND TEST SOLUTION AND THEIR PREPARATION</p> <ul style="list-style-type: none"> - Stock solution: in water, filtration after 2 h of stirring. <p>Dilution water: synthetic: CaCl₂ x 2 H₂O: 294 mg/l MgSO₄ x 7 H₂O 123 mg/l NaHCO₃ 63 mg/l KCl 5,5 mg/l</p> <ul style="list-style-type: none"> - Test temperature: 20 +- 1 °C - Hardness: 2.5 mmol Ca²⁺ and Mg²⁺, Ca²⁺ : Mg²⁺: 4: 1 <p>DURATION OF THE TEST: 24 h</p> <p>TEST PARAMETER: Immobilisation</p> <p>MONITORING OF TEST TEST ORGANISMS</p> <ul style="list-style-type: none"> - Strain: <i>Daphnia magna</i> - Supplier: Hüls AG - Age/loading: < 1 d, 5 - Feeding: Chlorella Vulgaris - Feeding during test: no <p>STOCK AND TEST SOLUTION AND THEIR PREPARATION</p> <ul style="list-style-type: none"> - Stock solution: in water, filtration after 2 h of stirring. <p>Dilution water: synthetic: CaCl₂ x 2 H₂O: 294 mg/l MgSO₄ x 7 H₂O 123 mg/l NaHCO₃ 63 mg/l KCl 5,5 mg/l</p> <ul style="list-style-type: none"> - Test temperature: 20 +- 1 °C

- Hardness: 2.5 mmol Ca²⁺ and Mg²⁺, Ca²⁺ : Mg²⁺: 4: 1

DURATION OF THE TEST: 24 h

TEST PARAMETER: Immobilisation

MONITORING OF TEST SUBSTANCE CONCENTRATION:
yes by DOC

Measured concentrations as mg/L	2,6 to 22
EC50, EL50, LC0, at 24,48 hours	24 h EC50 = 7 mg/l, EC10= 2.6 mg/l EC100= 22 mg/l
Biological observations	Immobilization
Appropriate statistical evaluations?	Regression analysis.
Remarks for results	Results based on DOC in mg/l.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Data Reliability Remarks	Code 2. Basic data given: comparable to guidelines/standards.
Reference	Degussa AG (1985b) Unpublished report. Report No. 85-0368-DKO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	DIN 38412 part 11
Test Type	Static
GLP	No
Year	1985
Analytical procedures	No
Species/Strain/Supplier	<i>Daphnia magna</i>
Test Details	24 hours
Remarks for Test Conditions	TEST ORGANISMS - Strain: <i>Daphnia magna</i> - Supplier: Hüls STOCK AND TEST SOLUTION AND THEIR PREPARATION Solution using a solubiliser: Marlowet ef - Concentrations: 12, 18, 25, 35 mg/l DURATION OF THE TEST: 24 hours TEST PARAMETER: Immobilisation

Nominal concentrations as mg/L	12-35
EC50, EL50, LC0, at 24,48 hours	EC50 = 19, EC0=12, EC100= 35
Appropriate statistical evaluations?	Regression analysis
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Data Reliability Remarks	Code 2. Basic data given: comparable to guidelines/standards.
Reference	Degussa AG (1985c) Unpublished report. Report No. 85-0378-DKO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	<i>Daphnia magna</i>
Test Details	48 hours
Remarks for Test Conditions	Based on: log KOW = 4.80, water solubility = 90 mg/L
EC50, EL50, LC0, at 24,48 hours	LC50 = 0.446 at 48 hours
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Data Reliability Remarks	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) US Environmental Protection Agency.

3.3 Acute Toxicity to Aquatic Plants

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	99.3 % purity (GC)
Method/guideline	EC 92/69/EEC

Test Type	Biomass/growth rate
GLP	Yes
Year	1992
Species/Strain/Supplier	<i>Scenedesmus subspicatus</i> (algae)
Endpoint Value	Growth
Exposure Period	72 hour
Analytical monitoring	Yes
Remarks for Test Conditions	- Initial cell concentration: 20000 cells/ml STOCK AND TEST SOLUTION AND THEIR PREPARATION - Dispersion: 1 g/l in synthetic fresh water, mixing over 18 hours, filtration, DOC determination.
Nominal concentrations as mg/L	4.4 to 148
Measured concentrations as mg/L	4.6 to 110
Unit	mg/L
Endpoint value	Growth
NOEC, LOEC or NOEL, LOEL	NOEC=14, EC10=15, and EC50= 29 mg/L.
Biological observations	EC50 for growth rate: 45 mg/l EC10 for growth rate: 21 mg/l
Control response satisfactory?	Yes
Appropriate statistical evaluations?	Yes
Conclusion remarks	EC50 (72 h, growth rate) = 45 mg/L EC10 (72 h, growth rate) = 21 mg/L
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Remarks for Data Reliability	Code 1. Comparable to guideline study.
Reference	Degussa AG (1994a) Unpublished report. Report No.: 94-0230-DGO.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	ECOSAR
Test Type	Calculated

Species/Strain/Supplier	Green algae
Exposure Period	96 hours
Remarks for Test Conditions	Based on: log KOW = 3.23, MP = 67 C, water solubility = 100 mg/L
Unit	mg/L
NOEC, LOEC or NOEL, LOEL	EC50 = 6.329 mg/L
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) US Environmental Protection Agency.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Remarks for Substance	Purity 99.1%
Method/guideline	EC Guideline 92/69/EEC
GLP	Yes
Year	1992
Species/Strain/Supplier	<i>Scendesmus subspicatus</i>
Endpoint Value	Biomass and growth rate
Exposure Period	72 hour
Analytical monitoring	Yes
Remarks for Test Conditions	As the test substance was not readily soluble in water, suspension of 1 g test substance/L was stirred for 18 hours. After that a filtrate of the suspension was used for the test. Temperature: 23.3-23.8 °C; pH: 7.5-9.3
Nominal concentrations as mg/L	0.76 to 27.3
Measured concentrations as mg/L	0.76 to 27.3
Unit	mg/L
NOEC, LOEC or NOEL, LOEL	NOEC = 6.8, EC10 = 8.2, EC50 = 17 mg/L
Control response satisfactory?	Yes
Appropriate statistical	Yes

evaluations?

Conclusion Remarks	Effect concentrations based on growth rate EC10 = 11 mg/L EC50 = 22 mg/L
Data Qualities Reliabilities	Reliability code 1. Reliable without restriction.
Remarks for Data Reliability	Code 1. Guideline study.
Reference	Degussa AG (1992) Unpublished report. Report No. 97-0308-DGO.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	ECOSAR
Test Type	Calculated
Species/Strain/Supplier	Green algae
Exposure Period	96 hours
Remarks for Test Conditions	Based on: log KOW = 4.80, water solubility = 90 mg/L
Unit	mg/L
NOEC, LOEC or NOEL, LOEL	EC50 = 0.084 mg/L
Data Qualities Reliabilities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Calculated.
Reference	ECOSAR EPI Suite (2000) US Environmental Protection Agency.

4 HUMAN HEALTH TOXICITY

4.1 Acute Toxicity

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Test Type	Acute Oral LD50
GLP	Yes
Year	1973
Species/strain	Rat
# of animals per sex per dose	10
Route of Administration	Oral
Value LD50 or LC50 with confidence limits	LD50 = 4200 mg/kg bw; Confidence limits 3620 - 4870 mg/kg.
Number of deaths at each dose level	95% confidence limit = 3620-4870 mg/kg. Toxic signs were immediate stimulation followed by ataxia.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Denine E.P. and Palanker A.C. (1973) Acute oral and dermal toxicity studies. Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	Acute Toxicity LD50
GLP	No
Year	1962
Species/strain	Mouse/CF1
Route of Administration	Intraperitoneal
Remarks for Test Conditions	Groups of 10 adult CF1 strain mice weighing 20-25 grams (6-8 weeks old) were injected with test compound and the resulting mortality was recorded for one week. The mice were housed 10 per cage in an air-conditioned room (75 to 80 F) and were provided food and water ad libitum. Vehicle was distilled H2O

	when possible. Compounds insoluble in H ₂ O were dissolved in mixtures of H ₂ O and propylene glycol or cottonseed oil or suspended in 0.5% solution of carboxymethylcellulose.
Value LD50 or LC50 with confidence limits	LD50 = 50-100 mg/kg.
Conclusion remarks	LD50 = 50-100 mg/kg.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Doull J., V.Plzak and S.J.Brois. (1962) A survey of compounds for radiation protection. Unpublished report.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Test Type	Acute Dermal LD50
GLP	No
Year	1973
Species/strain	Rabbit
# of animals per sex per dose	6
Route of Administration	Dermal
Value LD50 or LC50 with confidence limits	LD50 = greater than 5000 mg/kg bw
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Denine E.P. and Palanker A.C. (1973) Acute oral and dermal toxicity studies. Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Method/guideline	Litchfield and Wilcoxon, 1949
Test Type	Acute Oral LD50
GLP	No
Year	1964

Species/strain	Rat/Osborne-Mendel
Sex	Male and Female
# of animals per sex per dose	5
Vehicle	Corn oil
Route of Administration	Oral-Gavage
Value LD50 or LC50 with confidence limits	3180 mg/kg bw (2790-3620)
Remarks for Results	Slope function: 1.3 (95% CL 1.1-1.5)
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Jenner, P.M., Hagan, E.C., Taylor, J.M., Cook, E.L., and Fitzhugh, O.G. (1964) Food flavourings and compounds of related structure. I. Acute oral toxicity. <i>Fd Cosmet Toxicol</i> 2:327-343.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Method/guideline	Reed-Munch method
Test Type	Acute Oral LD50
GLP	No
Year	1975
Species/strain	Mouse
Sex	Male
# of animals per sex per dose	6
Route of Administration	Oral
Remarks for Test Conditions	Doses given ranged from 2000 to 5000 mg/kg bw and given as a 37.5% (w/v) emulsion.
Value LD50 or LC50 with confidence limits	4384 mg/kg bw
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.

References

Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Method/guideline	Litchfield and Wilcoxon, 1949
Test Type	Acute Oral LD50
GLP	No
Year	1975
Species/strain	Rat
Sex	Male
# of animals per sex per dose	5
Vehicle	0.85% saline
Route of Administration	Oral-Gavage
Value LD50 or LC50 with confidence limits	940 mg/kg bw (95% CL=534-1654)
Number of deaths at each dose level	250 mg/kg bw: 0/5 500 mg/kg bw: 1/5 1000 mg/kg bw: 3/5 2000 mg/kg bw: 4/5 3000 mg/kg bw: 5/5
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Comparable to guideline study with acceptable restrictions.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Test Type	Acute Oral LD50
Year	1975

Species/strain	Rat
# of animals per sex per dose	10
Route of Administration	Oral
Value LD50 or LC50 with confidence limits	LD50 = 5000 mg/kg.
Remarks for Results	Acute oral LD50 approximately equals 5000 mg/kg. Toxic signs were lethargy, tremors and chromodacryorrhea.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Moreno O.M. (1976) Acute toxicity studies in rats, mice, rabbits and guinea pigs. Unpublished report to RIFM.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Test Type	Acute Oral LD50
GLP	No
Year	1970
Species/strain	Rat
Sex	Not reported
Vehicle	Traganth
Route of Administration	Oral
Remarks for Test Conditions	Substance administered as a 2-30% emulsion
Value LD50 or LC50 with confidence limits	Approximately 4,800 ml/kg bw
Remarks for Results	Signs included dyspnea, shivering, cramping. At necropsy, rats showed bloody snouts and anus, diarrhea, enlarged gastrointestinal tract and bladder.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Zeller and Hofmann (1970) <i>p-tert</i> -Butylcyclohexylacetat. Ergebnis der Gewerbetoxikologischen Vorpruefung. Dated 21.7.1970.
Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate

CAS No.	32210-23-4
Test Type	Acute Oral LD50
GLP	No
Year	1976
Species/strain	Rat
Sex	Not reported
# of animals per sex per dose	10/dose
Route of Administration	Oral
Remarks for Test Conditions	Two doses administered: 500 or 5000 mg/kg bw
Value LD50 or LC50 with confidence limits	Less than 5000 but greater than 500 mg/kg bw
Number of deaths at each dose level	500 mg/kg bw: 3 deaths/10 rats 5000 mg/kg bw: 8 deaths/10 rats
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Opdyke, D.L. (1976) Acute oral toxicity in rats, dermal toxicity in rabbits. Report to RIFM dated May 21, 1976.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Test Type	IP LD50
GLP	No
Year	1970
Species/strain	Mouse
Sex	Not reported
Vehicle	Traganth
Route of Administration	Intraperitoneal
Remarks for Test Conditions	Substance administered as a 2-30% emulsion
Value LD50 or LC50 with confidence limits	Approximately 400 ml/kg bw
Remarks for Results	Signs included dyspnea, shivering, cramping. At necropsy, lesions were reported in the forestomach.

Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Zeller and Hofmann (1970) p- <i>tert</i> -Butylcyclohexylacetat. Ergebnis der Gewerbetoxikologischen Vorpruefung. Dated 21.7.1970.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Test Type	Acute Dermal LD50
GLP	No
Year	1976
Species/strain	Rabbit
Sex	Not reported
# of animals per sex per dose	4/dose
Route of Administration	Dermal
Remarks for Test Conditions	One dose of 5000 mg/kg bw administered. Insufficient test material to dose 10 rabbits.
Value LD50 or LC50 with confidence limits	Greater than 5000 mg/kg bw
Number of deaths at each dose level	5000 mg/kg bw: 1 death/5 rabbits
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Opdyke, D.L. (1976) Acute oral toxicity in rats, dermal toxicity in rabbits. Report to RIFM dated May 21, 1976.

4.2 Genetic Toxicity

4.2.1 *In vitro* Genotoxicity

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Test Type	Ames test
System of Testing	Bacterial
GLP	No
Year	1988
Species/Strain	<i>Salmonella typhimurium</i> TA98, TA 100, TA 1535, TA 1537, TA 1538
Metabolic Activation	With and without
Doses/Concentration	Up to 5000 ug/plate
Remarks for Test Conditions	<p>SYSTEM OF TESTING</p> <ul style="list-style-type: none"> - Metabolic activation system: Arochlor induced rat liver S9-mix of Bor: W/SW male rats (source SPF, TNO, NL) - No. of metaphases analyzed: no indicated - concentrations: 10 to 5000 micro-g/plate - Number of replicates: 2 one plate incorporation on pre-incubation test. - Positive and negative control groups and treatment: <p>Negative: Solvent, DMSO</p> <p>Positive: TA 98, TA 1528: Nitrofluorene, TA 100, TA 1535: Sodiumazide, TA 1537: Aminocridine</p> <p>Cytotoxicity: from 250 or 500 micro-g per plate</p>
Results	Negative
Cytotoxic concentration	250 to 500 micrograms/plate
Genotoxic Effects	None
Remarks for results	<p>GENOTOXIC EFFECTS:</p> <ul style="list-style-type: none"> - With metabolic activation: none - Without metabolic activation: none <p>CYTOTOXIC CONCENTRATION:</p> <ul style="list-style-type: none"> - With metabolic activation: 500 ug/plate

	- Without metabolic activation: 250 ug/plate TEST-SPECIFIC CONFOUNDING FACTORS: none STATISTICAL RESULTS: not given
Conclusion Remarks	Not mutagenic with and without metabolic activation
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (1988a) Unpublished report. Reg.Nr.: 88-0660-DKM.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	OECD Guideline 473
Test Type	Cytogenetic assay
System of Testing	Non bacterial
GLP	Yes
Year	1997
Species/Strain	Hamster/Chinese V79 lung cells
Metabolic Activation	With and without
Doses/Concentration	With metabolic activation: 20 - 500 micrograms/ml, without metabolic activation 20 - 200 micrograms/ml
Statistical Methods	For testing acceptable homogeneity between replicates: Binominal Dispersion Test (Richardson et al., 1989). Comparison of structural aberrations between treated and controls: Chi-square Test ($p < 0.05$).
Remarks for Test Conditions	Cytotoxicity screening test between 10 to 2000 micrograms/ml, solubility limit in Ethanol 1%. SYSTEM OF TESTING <ul style="list-style-type: none"> - Cell type: Chinese Hamster lung cells V79 - Metabolic activation system: Arochlor induced liver S9 fraction of male Sprague Dawley Rats. Cocentrations: without S9: 10, 60, 100 micro g/ml (test 1 and 2) with S9: 50, 250, 500 (test 1) and 20, 100, 200 micro g/ml (test 2) <ul style="list-style-type: none"> - Number of replicates: 2 per culture, 2 independent experiments. - Positive and negative control groups and treatment: Negative control: MEM 4 medium with and without S9 mix.

Positive controls:

Without metabolic activation: Mitomycin C 0.03 to 0.04 micro g/ml

With metabolic activation:

Cyclophosphamide, 3 and 4 micro g/ml

Harvest time: 18 and 28 hours

CRITERIA FOR EVALUATING RESULTS:

The chemical is regarded as clastogenic if:

- it induces chromosomal aberrations in a statistically significant manner in one or more concentrations.
- the induced proportion of aberrant cells at such test substance concentrations exceeds the normal range of the test system (greater than 5%).
- positive results can be verified in an independent experiment.

STATISTICAL METHODS:

For testing acceptable homogeneity between replicates: Binominal Dispersion Test (Richardson et al., 1989).

Comparison of structural aberrations between treated and controls: Chi-square Test ($p < 0.05$).

Results

Negative.

No biologically significant increases in chromosomal aberrations (excluding gaps) in both experiments with and without metabolic activation at both sampling times. A statistically significant increase in the highest concentration with S9 at the 28 hour sampling time was within the normal range of chromosomal aberrations of the test system and related to the low control incidence of the experiment (0%). As no dose related increase in chromosomal aberrations could be detected in the other experiments, this result was not considered biologically significant. 4-*tert*-Butylcyclohexanol was not clastogenic in this experiment.

Cytotoxic concentration

Without S9 mix 60 to 100 ug/ml, with S9 mix 200 to 500 ug/ml

Genotoxic Effects

None detected

Appropriate statistical evaluations?

Yes

Conclusion Remarks

The test substance was not clastogenic under the described experimental conditions

Data Qualities Reliabilities

Reliability code 1. Reliable without restriction.

Remarks for Data Reliability

Code 1. Guideline study.

References

Degussa AG (1997) Unpublished report. Report No. 97-0366-DGM.

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4
Method/guideline	Ames Test
Test Type	Ames reverse mutation
System of Testing	Bacterial
GLP	No
Year	1975
Species/Strain	<i>Salmonella typhimurium</i> TA 1535, TA 1537, TA 1538, TA98, TA 100
Metabolic Activation	With and without
Doses/Concentration	8-5000 ug/plate
Remarks for Test Conditions	<ul style="list-style-type: none"> - Metabolic activation system: Arochlor induced rat liver S9 mix - Number of replicates: 2 Preincubation method - Application: 8 to 5000 microg/plate - Positive and negative control groups and treatment: positive controls: TA 98, TA 158: 2.5 ug Nitrofluorene/plate TA 100, TA 1535: 2.5 ug Sodium-azid/plate TA1537: 50 ug aminoacridine/plate Negative control: solvent: Dimethylsulfoxide
Results	Negative
Cytotoxic concentration	200 and 400 micrograms/plate
Genotoxic Effects	GENOTOXIC EFFECTS: <ul style="list-style-type: none"> - With metabolic activation: not genotoxic - Without metabolic activation: not genotoxic
Remarks for Results	Toxic effects were observed at concentrations 200 ug/plate or higher.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Degussa AG (1989) Unpublished report. Report No, 89-350-DKM.

4.2.2 *In vivo* Genotoxicity

Substance Name	4- <i>tert</i> -Butylcyclohexanol
-----------------------	-----------------------------------

CAS No.	98-52-2
Remarks for Test Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Method/guideline	Chromosomal aberration
Test Type	Cytogenetic assay-Acute study
GLP	No
Year	1975
Species/Strain	Rat/Albino
Sex	Male
Route of Administration	Oral-Gavage
Doses/Concentration	Test 1: 1.45, 14.5, or 145 mg/kg bw; test 2: 500 or 3000 mg/kg bw
Exposure Period	6, 24 or 48 hours
Remarks for Test Conditions	Groups of rats were gavaged with 1.45, 14.5 or 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 500 or 3000 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 2) and groups of rats were killed at 6, 24 and 48 hours. 4 hours after administration and 2 hours prior to termination, rats were intraperitoneally injected with 4 mg colcemid/kg bw. Bone marrow was removed and slides were prepared and analyzed.
Genotoxic effects	None
Conclusion Remarks	2-Isopropyl-5-methylcyclohexanol did not induce chromosomal aberrations.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Test Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Method/guideline	Chromosomal aberration
Test Type	Cytogenetic assay-Subacute study
GLP	No
Year	1975

Species/Strain	Rat/Albino
Sex	Male
Route of Administration	Oral-Gavage
Doses/Concentration	Test 1: 1.45, 14.5, or 145 mg/kg bw; test 2: 1150 mg/kg bw
Exposure Period	Five doses 24 hours apart
Remarks for Test Conditions	Groups of rats were gavaged with 1.45, 14.5 or 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 1150 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 2) for 5 consecutive doses, 24 hours apart and were killed 6 hours after last dose. 4 hours after administration and 2 hours prior to termination, rats were intraperitoneally injected with 4 mg colcemid/kg bw. Bone marrow was removed and slides were prepared and analyzed.
Genotoxic effects	None
Conclusion Remarks	2-Isopropyl-5-methylcyclohexanol did not induce chromosomal aberrations.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Test Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Test Type	Micronucleus test
GLP	Ambiguous
Year	1993
Species/Strain	Mouse/B6C3F1
Sex	Male
Route of Administration	Intraperitoneal
Doses/Concentration	0, 250, 500, and 1,000 mg/kg bw
Exposure Period	3 daily exposures
Remarks for Test Conditions	Groups of 5-6 mice were intraperitoneally injected on 3 consecutive days with 1X, 0.5X and 0.25X of the test chemical. A positive control and solvent control were also used. 24 hours after the last treatment, mice were killed, bone marrow removed and slides were prepared. For each mouse, the number of MN-

	PCE in 2,000 PCE and the percent PCE in 200 erythrocytes were determined.
Effect on mitotic index or PCE/NCE ratio by dose level and sex	0 mg/kg bw: survival=5/5 mice; MN-PCE/1000=2.90; %PCE=54.4 250 mg/kg bw: survival=5/5 mice; MN-PCE/1000=3.60; %PCE=64.2 500 mg/kg bw: survival=5/5 mice; MN-PCE/1000=2.20; %PCE=56.7 1000 mg/kg bw: survival=3/6 mice; MN-PCE/1000=3.67; %PCE=51.8
Genotoxic effects	None
Appropriate statistical evaluations	Yes
Conclusion Remarks	2-Isopropyl-5-methylcyclohexanol was negative in the micronucleus test.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Comparable to guideline study with acceptable restrictions. Part of NTP study program.
References	Shelby, M.D., Erexson, G.L., Hook, G.J., and Tice, R.R. (1993) Evaluation of a three-exposure mouse bone marrow micronucleus protocol: Results with 49 chemicals. Environ Mol Mutagen 21:160-179.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Test Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Test Type	Host-mediated-Acute study
GLP	No
Year	1975
Species/Strain	Mouse/ICR
Sex	Male
Route of Administration	Oral-Gavage
Doses/Concentration	Test 1: 1.45, 14.5 and 145 mg/kg bw; Test 2: 500 and 5000 mg/kg bw
Exposure Period	Single exposure
Remarks for Test Conditions	Indicator organisms were <i>Salmonella typhimurium</i> strains G46 and TA1530, and <i>Saccharomyces cerevisiae</i> D3. Groups of mice were given 1.45, 14.5 and 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 500 or 5000 mg 2-

isopropyl-5-methylcyclohexanol/kg bw (test 2) by gavage followed by intraperitoneal injection of 2 ml indicator organism. Three hours later, mice were killed and intraperitoneally injected with 2 ml of sterile saline. As much fluid as possible was removed from the peritoneal cavity and dilutions were made from each exudate. Dilutions were plated and incubated for 18-40 hours. Further dilutions were made, plated and incubated at 30 °C for 40 hours after which bacterial scoring was conducted for calculation of mutation frequency and recombinant frequency.

Genotoxic effects	Only at 5000 mg/kg bw in <i>Salmonella</i> TA1530.
Remarks for Results	In vitro tests using same organisms were all negative.
Conclusion Remarks	No significant increase in mutant and recombinant frequency at any dose in <i>Salmonella</i> G46 and <i>Saccharomyces</i> D3. At the highest dose tested in <i>Salmonella</i> TA1530 a significant increase in mutant frequency was reported.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Test Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Test Type	Host-mediated-Subacute study
GLP	No
Year	1975
Species/Strain	Mouse/ICR
Sex	Male
Route of Administration	Oral-Gavage
Doses/Concentration	Test 1: 1.45, 14.5 and 145 mg/kg bw; Test 2:1150 mg/kg bw
Exposure Period	Five doses 24 hours apart
Remarks for Test Conditions	Indicator organisms were <i>Salmonella typhimurium</i> strains G46 and TA1530, and <i>Saccharomyces cerevisiae</i> D3. Groups of mice were given 1.45, 14.5 and 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 1150 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 2) by gavage for 5 consecutive doses, 24 hours apart. Thirty minutes after the last dose, mice were given an intraperitoneal injection of 2 ml indicator

organism. Three hours later, mice were killed and intraperitoneally injected with 2 ml of sterile saline. As much fluid as possible was removed from the peritoneal cavity and dilutions were made from each exudate. Dilutions were plated and incubated for 18-40 hours. Further dilutions were made, plated and incubated at 30 °C for 40 hours after which bacterial scoring was conducted for calculation of mutation frequency and recombinant frequency.

Genotoxic effects	Elevated recombinant frequency in <i>Saccharomyces</i> D3
Conclusion Remarks	No significant increase in mutant and recombinant frequency at any dose in <i>Salmonella</i> G46 and TA1530, but in <i>Saccharomyces</i> D3 an elevation of recombinant frequency was reported. In vitro tests using same organisms were all negative.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Test Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Test Type	Dominant lethal assay-Acute study
GLP	No
Year	1975
Species/Strain	Rat/Random bred
Sex	Male
Route of Administration	Oral-Gavage
Doses/Concentration	Test 1: 1.45, 14.5, or 145 mg/kg bw; test 2: 500 or 3000 mg/kg bw
Exposure Period	Single dose
Remarks for Results	Groups of male rats were gavaged with 1.45, 14.5 or 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 500 or 3000 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 2). Male rats were mated with 2 female rats per week for 8 weeks. Fourteen (14) days after mating, females were killed and the uterus was examined for early deaths, late fetal deaths and total implantations.
Data Qualities Reliabilities	Reliability code 2. Reliable with restriction.

Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).

4.3 Repeated Dose Toxicity

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Method/guideline	OECD Guideline 407
GLP	Yes
Year	1998
Species/strain	Rat/Wistar
Sex	Male and Female
Route of Administration	Oral-Gavage
Doses/concentration Levels	50, 150, 300 mg/kg bw/day
Exposure Period	28 days
Frequency of Treatment	Once daily
Control Group	Yes, concurrent vehicle
Post exposure observation period	14 days
Remarks for Test Conditions	<p>TEST ORGANISMS</p> <ul style="list-style-type: none"> - Age: 6 to 8 weeks - Weight at study initiation: 183-188.9 g variation less than 20% - Number of animals: 30 male, 30 female <p>ADMINISTRATION / EXPOSURE</p> <ul style="list-style-type: none"> - Duration of test/exposure: 28 day - Type of exposure: gavage - Post exposure period: 14 days - Vehicle: corn oil - Concentration in vehicle: 10, 30, 60 mg/ml - Total volume applied: 5 ml/kg

- Doses: 50, 150, 300 mg/kg per day

CLINICAL OBSERVATIONS AND FREQUENCY:

- Clinical signs: general health: twice daily, general clinical observations: once daily.

A detailed FOB in home, cage and open field was conducted once per week. During the final week of the dosing period all animals were subject to an extended FOB, extended open field observation test, sensory reactivity to different stimuli, motor activity assessment, landing foot splay, grip strength, rearing behaviour.

- Body weight: At allocation of the groups, prior to first dose, weekly.
- Food consumption: weekly
- Water consumption: daily
- Haematology, at the end of the treatment period/recovery period:

RBC, WBC, Platelet count, Haemoglobin, Hematocrit, MCV, Mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration. Differential WBC, coagulation.

- Biochemistry: at the end of the treatment period/recovery period: sodium, potassium, calcium, AST, ALT, AP, Glucose, Triglycerides, cholesterol, total bilirubin, BUN, Creatinine, total protein, albumin.
- Urinalysis: after 6 hours in metabolic cages before termination, Volume, pH, specific gravity, colour, protein, glucose, ketones, urobilinogen, blood, sediment analysis for leukocytes, erythrocytes, bacteria, epithelial cells squamous and renal, oxalate crystals, triple phosphate crystals, carbonate, granular cylinder, urate crystals.

ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):

- Macroscopic:

Organ weights of following organs were determined: liver, kidney, adrenals, spleen, heart, thymus, brain, male gonads and epididymis.

- Microscopic:

The following organs and all gross lesions were preserved in formalin for all dose groups. In high dose and controls all organs were examined histopathologically and selected organs of the other dose groups were also examined.

Organs: Adrenals, aorta, anus, brain, all parts of the intestinal tract, epididymides, eyes, ex-orbital lacrimal glands, heart, kidneys, larynx, liver, lungs, lymph nodes (skin, cervical, mesenteric), mammary gland, muscle, ovaries, oesophagus, pancreas, pituitary, prostate, salivary glands, sciatic nerve, seminal vesicles, skin, spinal cord, spleen, stomach, sternum, testes, thymus, thyroid, parathyroid, tongue, trachea, urinary bladder, uterus, vagina.

STATISTICAL METHODS:

For FOB: Kruskal Wallis non parametric analysis of variance, in case of significance: pairwise comparison with Wilcoxon, Mann, Whitney U-Test.

Other data: ANOVA or Kruskal Wallis test if heterogenous

NOAEL(NOEL)

50 mg/kg bw

LOAEL(LOEL)

150 mg/kg/bw

Toxic Response/effects by Dose Level

Mortality: 2 animals of the high-dose group died due to an application failure and were replaced by two recovery animals. Clinical symptoms: 15 min after test substance administration high and medium dose group: convulsions, squatting position, straub tail (one female animal of the high-dose group) and vocalization. Some animals were walking on tiptoes. The symptoms disappeared within a few hours to 1 day. No clinical abnormalities were observed in the controls and recovery animals. FOB: After the first and second day of the treatment period no abnormalities were observed. After 2, 3 and 4 weeks of treatment clinical symptoms were observed in individual animals predominantly in the high-dose group. The effects included ataxia, padding movements, defense against touching, aggressiveness, hunchback/squatting position, reduced respiration, hyperactivity, straub tail, slight convulsions. In the recovery period (week 5 and 6) no significant treatment-related clinical signs were observed in all dose groups. Extended FOB week 4: Reactivity to standard stimuli was normal in the control, low and medium dose animals. Individual animals of the high-dose group showed minimal to high sensitivity of pain. One male showed catalepsy. Rearing, landing foot splay and grip strength was normal in the control, low, medium and high-dose groups and in the recovery group females. High-dose male recovery group animals showed a statistically significant increase of group mean values of landing-foot-splay and rearing and a decrease of group mean values of grip strength compared to recovery controls, but these differences were minor and did not show a consistent pattern in the individual animals. The effects were also not seen in the high-dose group males that were not allocated to the recovery group at the same examination time. Therefore the findings were considered of minor toxicological importance. No statistically significant increase in motor activity was observed in all dose groups comparing group mean values to that of controls. A statistically non-significant increase was observed in high-dose animals, in particular females.

Body weights: A slight decrease in body weight and body weight changes was observed in the high-dose males (statistically significant only for high-dose recovery group males in week 4. The females of the high-dose recovery group showed an increase of group mean body weight change at the beginning of the study. In the recovery period no statistically significant differences in body weights and body weight gains were observed.

Food intake: A slight reduction was seen in treated males and an increase in treated females when compared to controls.

During the recovery period the food consumption of the treated animals was increased compared to controls. Water consumption was not different between treated and control groups. Alterations in clinical chemistry, urinalysis and hematology parameters were minor and within the normal range of the historical data. All differences observed were considered of minor toxicological importance.

Organ weights: At the end of the treatment period male high-dose group animals showed a statistically significant increase in relative adrenal weight when compared with controls. At the end of the recovery period the treated males revealed a statistically significant increase in relative epididymis weight compared to the controls at the highest dose. This change was not observed at the end of the treatment period.

Histopathology:

Treatment-related findings were restricted to an increased number of male animals of the high-dose group with eosinophilic hyaline droplets in the epithelial cell cytoplasm of the proximal tubules (5 treated compared to 1 control). This could be indicative of the alpha-2 microglobulin nephropathy syndrome in male rats that is a rat-specific effect. There was no evidence of histopathology for any of the male or female sex organs or tissues including the epididymis. The deaths were not treatment related.

Remarks for Results

Based on the clinical signs a NOAEL of 50 mg/kg bw and a LOAEL of 150 mg/kg bw were derived. *Alpha*-2-microglobulin effects in males were reported at the highest dose levels.

Conclusion Remarks

The main effects of the test substance are clinical signs of neurotoxicity at the high and mid dose. No histopathological changes that are considered relevant for humans were observed.

Data Qualities Reliabilities

Reliability code 1. Reliable without restriction.

Remarks for Data Reliability

Code 1. Guideline study.

References

Degussa AG (1999) Unpublished report. Report No. 98-0184-DGT.

4.4 Reproductive/Developmental Toxicity

Substance Name	4- <i>tert</i> -Butylcyclohexyl acetate
CAS No.	32210-23-4

Remarks for Substance	Data for commercial mixture of cis and trans isomers: 71% trans and 28% cis; >99%
Method/Guideline	<i>in vivo</i> Developmental Toxicity Study (OECD No. 421 Guideline Study)
GLP	Yes
Year	2006
Species/Strain	Rat/Crl:CD(SD)
Sex	Females and males
Route of Administration	Oral-Gavage
Duration of Test	14 days (day 7 through day 20 of gestation)
Doses/Concentration	0, 40, 160, or 640 mg/kg bw
Premating Exposure period for females	14 days
Control Group and Treatment	Yes, vehicle only (corn oil)
Frequency of Treatment	Daily
Remarks for Test Conditions	<p>This study was conducted to provide screening information concerning the potential systemic, reproductive (female) and developmental toxicity of 4-t-butylcyclohexyl acetate when administered orally, by gavage, to female rats using a modified OECD 421 protocol. Groups (25/group) of rats were individually housed in stainless steel, wire-bottomed cages, except during the cohabitation period. During cohabitation, each pair of rats was housed in the male rat's cage. Female rats were at least 67 days old and weighed between 200 and 225 g at 60 days. Rats were administered food and water <i>ad libitum</i> and were exposed to daily cycles of 12 hours of light and 12 hours of darkness. After acclimation, virgin female rats were cohabited with breeder male rats, one male rat per female rat. The cohabitation period consisted of a maximum of five days. Female rats with spermatozoa observed in a smear of the vaginal contents and/or a copulatory plug observed <i>in situ</i> were considered to be at day 0 of presumed gestation and assigned to individual housing and randomly assigned to test or control groups. Based on the range-finding study results (see below) females were administered doses of 0, 40, 160, or 640 mg/kg of 4-t-butylcyclohexyl acetate in corn oil (dose volume, 10 ml) by gavage daily from days 7-20 of gestation. Clinical observation were made twice daily.</p> <p>Rats were Caesarean-sectioned on day 21 of gestation and fetuses were removed from the uterus and placed in individual containers. The rats were examined for number and distribution of corpora lutea, implantation sites and placentae that appear abnormal (size, color or shape). Live and dead fetuses and early and late resorptions were recorded.</p>

Foetuses were examined for sex and for gross external alterations. Late resorptions and dead fetuses also were examined for sex and for gross external alterations but such observations were included in either data summarization or statistical analyses. The body weight of each fetus was recorded. Only body weights of live foetuses were used to determine litter fetal body weight averages. Approximately one-half of the foetuses in each litter were examined for soft tissue alterations by using an adaptation of Wilson's sectioning technique [Wilson (1965)]. These foetuses were initially fixed in Bouin's solution; sections were retained in alcohol. The remaining foetuses (approximately one-half of the foetuses in each litter) were examined for skeletal alterations after staining with alizarin red S [Staples *et al* (1964)]. The foetuses were initially fixed in alcohol; skeletal preparations were retained in glycerin with thymol added as a preservative. Representative photographs of fetal gross, soft tissue and skeletal alterations will be taken.

Range finding study:

Dosages were selected on the basis of findings from a dosage-range study in which 4-t-butylcyclohexyl acetate (4-t-BCHA) dosages of 37.5, 50, 150, and 300 mg/kg/day were administered to pregnant rats once daily for 14 consecutive days (DGs 7 through 20). No mortality occurred at dosages as high as 300 mg/kg/day. At 50 mg/kg/day and higher, slight excessive salivation and urine stained abdominal fur were observed. In the 50, 150, and 300 mg/kg/day dosage groups, increased numbers of rats lost weight after the first treatment on DG 7, and after the second dosage (DGs 8 to 9) a dosage-dependent reduction in maternal body weight gain was observed. For the entire dosage period, body weights and body weight gains were comparable between treatment and control groups. Absolute and relative feed values were reduced in the 50 and 300 mg/kg/day dosage groups during the first three days of treatment compared to the vehicle control group. One rat in the 150 mg/kg/day dosage group had very high feed consumption in the first three days of treatment, and if this outlying value is removed then a dose-dependent reduction in feed consumption in the first three days of treatment was observed. For the entire dosage period, absolute and relative feed consumption values were comparable between treatment and control groups. No test article-related Caesarean-sectioning, litter, or foetal gross effects were observed.

Due to the lack of sustained effects on maternal body weight and food consumption at the highest dose tested in the dosage-range finding study, 300 mg/kg/day, a dose of 640 mg/kg bw was selected for the definitive study. This dosage is anticipated to result in maternal body weight and feed consumption effects during the entire dosage period.

NOAEL(NOEL)

640 mg/kg bw

Actual dose received by dose level and sex	0, 40, 160, or 640 mg/kg bw
Appropriate statistical evaluations	Yes {Dunn (1964); Dunnett (1955); Siegel (1956); Snedecor <i>et al</i> (1967a); Snedecor <i>et al</i> (1967b); Sokal <i>et al</i> (1969a); Sokal <i>et al</i> (1969b)}
Parental data and F1 as Appropriate	These are preliminary results presented in the draft report. The final report will be available 3/07.

This study was conducted to provide screening information concerning the potential systemic, reproductive and developmental toxicity of 4-t-butylcyclohexyl acetate when administered orally, by gavage, to female rats using a modified OECD 421 protocol. 4-t-Butylcyclohexyl acetate was administered at doses of 40, 160, and 640 mg/kg/day in corn oil by gavage; the control group received the vehicle at an equivalent volume. Males were used exclusively for breeding and not treated. The females were treated for 14 days gestation. Females underwent Caesarean section on Day 21 and their offspring. The parental rats were subject to a gross and microscopic examination. The rats were examined for number and distribution of corpora lutea, implantation sites and placentae that appear abnormal (size, color or shape). Live and dead fetuses and early and late resorptions were recorded.

There was no mortality, and there were no clinical signs of toxicity or differences in body weights, weight gain, feed consumption or organ weights. Copulation and fertility indices, precoital intervals, gestation lengths and pregnancy rates were comparable among the test and control groups, and no signs of prolonged delivery or unusual nesting behaviours were noted. Pup viability, body weights, external observations and necropsy and microscopic examination showed no significant alterations that could be related to administration of the test material data were comparable among the groups. The NOAEL for systemic, reproductive, and developmental toxicity was 640 mg/kg/day.

(This robust summary will be revised after publication of the final study report)

Offspring toxicity F1 and F2

Conclusion remarks

Data Reliabilities Qualities Reliability code 1. Reliable without restriction.

Remarks for Data Reliability Code 1. OECD guideline study.

References Lewis E. M. (2006) Oral (Gavage) developmental toxicity Study of 4-tert butylcyclohexyl acetate (4-tBCHA) in rats. Charles

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Data are for white spirits dry cleaning solvent containing t-butylcyclohexane that metabolizes to 4-t-butylcyclohexanol in rats (Henningsen et al. 1987).
Test Type	Teratogenicity study
GLP	No
Year	1982
Species/Strain	Rat/Wistar
Sex	Female
Route of Administration	Inhalation
Frequency of treatment	6 hours/day on days 6-15 of gestation and days 3-20 for highest dose
Doses/Concentration	Test 0, 1.58, 2.795, or 5.510 mg/l
Control Group and Treatment	Yes, concurrent control
Remarks for Test Conditions	Groups of female rats were exposed to atmospheres containing 1.580, 2.795 or 5.510 mg/l, 6 hours daily on days 6-15 of gestation. Also groups of female rats were exposed to the highest dose on days 3-20 of gestation.
Conclusion remarks	No effect on early deaths, late fetal deaths and total implantations was reported. Signs of maternal toxicity included temporary mild decreased weight gain and eye irritation.
Data Reliabilities Qualities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Study concentration of t-butylcyclohexane not measured. Therefore, in vivo concentration of 4-t-butylcyclohexanol is not known.
References	World Health Organization (1982) Selected petroleum products. <i>Environmental Health Criteria</i> , 20 ,34.

Substance Name	4- <i>tert</i> -Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Test Type	Dominant lethal assay- Subacute study

GLP	No
Year	1975
Species/Strain	Rat/Random bred
Sex	Male
Route of Administration	Oral-Gavage
Doses/Concentration	Test 1: 1.45, 14.5, or 145 mg/kg bw; test 2: 1150 mg/kg bw
Control Group and Treatment	Saline
Frequency of Treatment	Five doses 24 hours apart
Remarks for Test Conditions	Groups of rats were gavaged with 1.45, 14.5 or 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 1150 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 2) for 5 consecutive doses, 24 hours apart. After the last dose, male rats were mated with 2 female rats per week for 7 weeks. 14 days after mating, females were killed and the uterus was examined for early deaths, late fetal deaths and total implantations.
Conclusion remarks	No effect on early deaths, late fetal deaths and total implantations was reported when 2-isopropyl-5-methylcyclohexanol was administered to male rats prior to mating.
Data Reliabilities Qualities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).
Substance Name	4-tert-Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Data are for isomeric alcohol 2-Isopropyl-5-methylcyclohexanol (dl-menthol)
Test Type	Dominant lethal assay-Acute study
GLP	No
Year	1975
Species/Strain	Rat/Random bred
Sex	Male
Route of Administration	Oral-Gavage
Frequency of treatment	Single dose
Doses/Concentration	Test 1: 1.45, 14.5, or 145 mg/kg bw; test 2: 500 or 3000 mg/kg bw

Control Group and Treatment	Saline
Remarks for Test Conditions	Groups of male rats were gavaged with 1.45, 14.5 or 145 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 1) or 500 or 3000 mg 2-isopropyl-5-methylcyclohexanol/kg bw (test 2). Male rats were mated with 2 female rats per week for 8 weeks. 14 days after mating, females were killed and the uterus was examined for early deaths, late fetal deaths and total implantations.
Conclusion remarks	No effect on early deaths, late fetal deaths and total implantations was reported when 2-isopropyl-5-methylcyclohexanol was administered to male rats prior to mating.
Data Reliabilities Qualities	Reliability code 2. Reliable with restriction.
Remarks for Data Reliability	Code 2. Basic data given: comparable to guidelines/standards.
References	Food and Drug Administration (FDA) (1975) Mutagenic evaluation of compound FDA 71-57, menthol. NTIS PB-245-444 (FDA 71-268).
Substance Name	4-tert-Butylcyclohexanol
CAS No.	98-52-2
Remarks for Substance	Metabolite of t-butylcyclohexane (constituent of white spirits solvent)
Test Type	Occupational exposure
GLP	No
Year	1981
Species/Strain	Human-print workers
Sex	Male
Route of Administration	Inhalation
Doses/Concentration	Occupational exposure up to 294 mg/m ³ of white spirits
Control Group and Treatment	None
Frequency of Treatment	Work week for 1 to 17 years
Remarks for Test Conditions	In another study, 11 men in a printing factory were occupationally exposed to a wide variety of solvents, including 294 mg/m ³ of white spirits for 1-17 years. Sperm counts, motility, and morphology were monitored for 2 months.
Conclusion remarks	All values monitoring reproductive potential were normal.
Data Reliabilities Qualities	Reliability code 4. Not assignable.
Remarks for Data Reliability	Code 4. Occupational study monitoring reproductive potential of workers

References

Tuohimaa P., and Wickmann L. (1981) Sperm production of men working under heavy-metal or organic-solvent exposure. In: Hemminki K, Sorsa M, Vainio H, eds. Occupational hazards and reproduction. Washington, DC: Hemisphere Publishing Corp., 73-79.